Use of Carbon Fiber Reinforced Polymers in Strengthening PF-4 at Los Alamos

Eric MacFarlane, Los Alamos National Laboratory

The Pajarito Fault System borders the western edge of Los Alamos National Laboratory. However, much of the laboratory's infrastructure inventory was designed for earthquakes with much lower ground acceleration than the current probabilistic estimates. As a result, we are now reevaluating the seismic safety of many laboratory facilities and strengthening systems where needed.

In 2013, Los Alamos National Laboratory began discussing the use of Carbon Fiber Reinforced Polymers
(CFRP) for strengthening elements in PF-4. To date, this material has been used to strengthen captured-concrete-short columns and several roof girders in PF-4. The captured-short-columns required strengthening to improve ductility and their subsequent ability to support lateral displacements and vertical loads associated with a beyond PC-3 seismic event. Starting in 2014, we employed the same material to add shear capacity to the roof girders in PF-4. This project is currently undergoing installation. These projects represent the first installations of CFRP inside a nuclear facility in the United
States.

The presentation will include a discussion of the following:

- Project specifics and difficulties associated with installation of CFRP inside PF-4.
- Integration of ACI 318 and 349 Chapter 21 (seismic requirements) with ACI 440.2R (Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures).
- Degradation of CFRP mechanical properties from radiation. The project team leveraged the capabilities of the Los Alamos Neutron Science Center (LANSCE) for the radiation studies.